What Puts the Fab in Prefab?

How BIM and Prefabrication Can Save Time and Money

Written by: Debra Wood for Constructor Magazine

Although prefabrication has existed for centuries, building information modeling (BIM) and virtual design and construction (VDC) have given the construction method a boost, saving contractors time and money.

"BIM is the driver of prefabrication," says Walter Benoit, senior vice president of operations for Skanska USA Building in Durham, North Carolina. "BIM provides a quick visual of the overall system and space requirements. It allows [subcontractors] to start layout and design early."

Sundt Construction builds major components of its projects using prefabrication, reports Ryan Abbott, senior vice president of Sundt in Tempe, Arizona.

"BIM increased opportunities for prefabrication," Abbott says.

Katie Wells, director of Lean construction at Brasfield & Gorrie in Birmingham, Alabama, reports "BIM plays a pivotal role in early design coordination because we can see the opportunities for prefabrication play out as the design evolves."

Modeling gives contractors the confidence to prefabricate components or assemblies, adds Erik Lewis, director of BIM/VDC at St. Paul, Minnesota-based Harris, which operates prefabrication shops as part of its mechanical engineering work.

"It's a different way of thinking about construction," Lewis says.

THE BIM TO PREFAB PROCESS

Brasfield & Gorrie starts incorporating prefabrication into its design sets as early as schematic design, involving trades and prefab partners to inform the design. Wells says that turning to prefabrication later in the process can make it cost-prohibitive.

"The earlier you agree on doing prefab the better," Benoit says. "The designer needs to be brought in and understand the added weight of the racks and the special layout criteria."

Sometimes the owner and designer determine up front that the project will use prefab. Subcontractors may prefab their portion of the work, such as an electrician prefabbing the in-wall box and conduit, even if not required, Benoit adds.

"The essential component in the success of prefabrication during design is bringing critical trade contractors on board early to lay all potential opportunities on the table and start incorporating those decisions into the model," Wells says. "By making early decisions around prefabrication components, the team has more time to coordinate and produce a design for production."

Architects provide the construction firm the model. The contractor builds the project in the model, assuring everything will come together properly, Abbott explains. The model also allows the contractor to know the assembly can be moved to the site and fit under bridges and state how much each component weighs, so the contractor can ensure its crane capacity will be able to lift it.

"BIM gives certainty around the assemblies," Lewis adds.

One caveat is inspections. Benoit recommends prefabricating near the jobsite for modular units such as bathroom pods and electrical rooms, so inspectors can inspect at the prefab shop.

"You have to make sure there is an agreement in place with the inspection group and that they are OK doing the inspection at the warehouse," Benoit says.

Prefab elements of a job are built in a climate-controlled warehouse or shop, and when complete and the project team is ready for the prefab assemblies, they are hauled to the jobsite, lifted into place and connected.

Harris adds QR codes to the assembly, which indicate where the prefabricated component should be installed at the job. It also allows managers to track the item's progress and understand the cost to budget or schedule if changes are made.

WHY PREFABRICATE?

Contractors prefab for multiple reasons, including getting a head start on the work. Prefabbing elements can begin long before those sections of the project are needed at the jobsite. That allows for delays in the material supply chain, particularly problematic during the COVID-19 pandemic.

"Work can take place year-round in regions of the country with limited construction seasons," Lewis says.

Since the tasks are completed indoors, craftspeople are working in a comfortable environment, at waist level. That leads to safer construction. No trade professionals are reaching overhead or climbing on ladders and lifts. And fewer people are needed at the jobsite.

"Everything you need is at your fingertips," Abbott says. "Work can be taking place at multiple locations at the same time."

Quality occurs as a byproduct.

"You have less rework when these things are manufactured off-site," Benoit says.

Prefabrication also can shorten the schedule and duration of labor on the jobsite and lower the skill set of the people needed to assemble the parts.

"That's a benefit for the project and owner and a challenge for labor," Lewis says.

However, in many areas, skilled labor remains difficult to find. An AGC and Autodesk survey, reported in September 2021, found 89% of contractors are having a hard time finding craft workers.

With prefabrication, "everyone can work together at the same time," Benoit says. "This reduces the number of people needed at the jobsite."

Abbott considers prefabrication a risk reduction strategy.

"The more you can do ahead of the critical path of the project, the more you are able to accommodate for something else that might occur during a project," Abbott says. "We also do it for supply chain optimization."

Additionally, firms prefabricate, because it reduces waste, something important with high-cost items.

"If you are building something on the site, you will throw away the tails before taking them to the next level," Abbott says. "But if you are building in a controlled environment, you will utilize every piece and part, and you can because you have a place to store it."

BUILDINGS THAT LEND THEMSELVES TO PREFABRICATION

Certain jobs lend themselves to prefab, such as buildings with the same layout on each floor, and large, complicated projects.

"With something highly repeated, you engineer out the learning curve and you become more efficient," Abbott says.

If the contractor is brought on early, the company can work with mechanical, electrical and plumbing (MEP) trades for design assist and look for opportunities for prefabrication.

"There is value in going with multi-trade prefabrication," Lewis says.

Skanska has frequently prefabricated portions of jobs, including entire bathrooms, shafts with all of the MEP systems inside a frame, mechanical rooms, duct work, electrical rooms, main corridor systems and hospital head walls.

Sundt uses prefabrication when building central utility plants, water treatment facilities, hospital head walls, and exterior walls on high-rise buildings and other big jobs.

"There are numerous components that lend themselves to prefabrication. In a healthcare project, that may include operating room ceilings, headwalls, bathroom pods, exterior wall panels, multi-trade racks, electrical rooms and more," Wells says. "We've also looked into prefabricating entire rooms and modules, such as patient rooms."

Brasfield & Gorrie has prefabricated bathroom pods on a major hotel project, including the wrap and support pallet.

"Doing so allowed us to plan how the pods would be loaded onto each floor by determining the exact pathway that would accommodate the size," Wells says. "The route the pods took upon delivery avoided interfering with other tasks taking place in the same location. This streamlined installation and saved time by allowing surrounding tasks to continue unhindered."

The new frontier will be taking prefabrication to even more complex and larger components, such as hotel rooms with furniture and art on the walls, Lewis says. However, that entails shipping air, which is costly.

"There are companies pushing it more and more," Lewis adds.

BIM and modeling holds the promise of greater efficiencies and productivity.

"The future is fully adopting and utilizing models to build, and it's reducing the risk and misunderstanding between design and construction," Abbott concludes. "When you can use BIM to make workers safer, have more productivity and a common understanding, it's an exciting proposition."

About the Author

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About the Article

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Photo 1 - Sundt

Photo 2 - Harris

Photo 3 - Brasfield & Gorrie